

Stephanofilariasis Caused by *S. Okinawaensis* of Cattle in Japan

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Species of the genus *Stephanofilaria* are spread all over the world. *Stephanofilaria dedoesi*, *S. assamensis*, and *S. kaeli* have been known in Southeast Asia, India, and Pakistan. *S. stilesi* has been known in the U.S.A. and the U.S.S.R. These species attack cattle mainly, causing intractable chronic parasitic dermatitis. The species reported from Southeast Asia, India and Pakistan have also induced this type of dermatitis in water buffaloes and goats.

The principal site of appearance of cutaneous changes varies with the species of *Stephanofilaria*. Nevertheless, all the species of this genus seem to give rise to essentially the same clinicopathological changes.

In Japan, Kono (1965) made it clear that a strange type of dermatitis caused by infection with *Stephanofilaria* sp. was prevalent among cattle in the Southwestern Islands. The main symptoms of the dermatitis were eczema-like changes of the muzzle and removal of melanin from this area. At that time the economic damage caused by the changes of the muzzle was estimated to be slight in the cattle industry. Therefore, no general interest was so much concentrated on the importance of this type of dermatitis.

Recently, it has been reported that a considerably large number of multiparous cows have teats affected to various degrees of

intensity with a chronic inflammatory skin disease in the same district where the strange dermatitis is prevalent, and that serious damage is inflicted on the production and raising of cattle there. Then the authors began to perform studies on the actual state of occurrence and the etiology of this disease.

The results of these studies obtained so far were reported by Ueno & Chibana (1977) and by Ueno, Chibana & Yamashiro (1977). In the present paper the contents of both reports are summarized and some results obtained from the latest research and investigation are mentioned additionally.

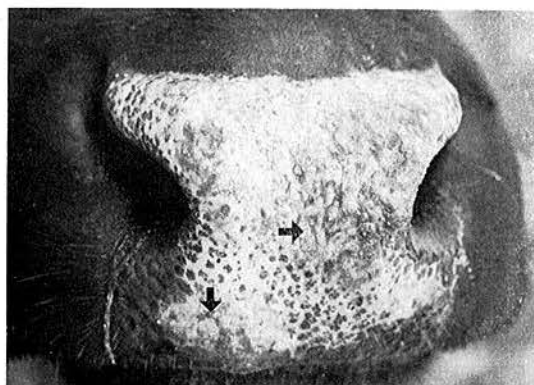


Plate 1. Changes of the muzzle of a Japanese Black cow induced by infection with *Stephanofilaria okinawaensis*. Melanin disappeared almost completely from the muzzle, which turned to be pale. The remaining melanin formed islets on the mucous membrane of the muzzle. Arrow indicates an erosive part.

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Plate 2. Changes of the teat of a Japanese Black cow induced by infection with *Stephanofilaria okinawaensis*. A big crack were produced at the root of the teat. The lesion turned to be pale.

Stephanofilaria okinawaensis Ueno & Chibana, 1977

Kono (1965) collected a species of *Stephanofilaria* from a lesion of the muzzle of cattle reared in the Ryukyu Islands, Amami-Oshima, and Tokara Island of the Southwestern Islands. This parasite was morphologically similar to, or a little different from, *S. assamensis* which had been described by Pande (1936). It was clearly different clinico-pathologically from *S. assamensis*, because it induced clinico-pathological changes mainly in the hump. Kono (1965) obtained these findings, but described this species simply as *Stephanofilaria* sp., without proposing any specific name for it.

Ueno & Chibana (1977) collected many *Stephanofilaria* worms from bovine teats affected with the chronic inflammatory skin disease prevailing in the Southwestern Islands, particularly in the Yaeyama Islands. From these parasites conventional transparent worm-body preparations were prepared with lactophenol to examine morphological characteristics and measure various values. The results obtained were compared with those obtained from various known species of *Stephanofilaria*. Moreover, the tegmental surface structure of those parasites was observed by the scanning electron microscope. As a result, the authors

concluded that those parasites should be classified into a new species of *Stephanofilaria* independent from any known species of this genus, judging from the principle of classification of the genus. Therefore, the authors proposed the name *S. okinawaensis* for the parasite. Those classified into this species were perfectly identical with those classified into *Stephanofilaria* sp. by Kono (1965). They presented the same morphological characteristics as the *Stephanofilaria* worms collected by the authors from the lesion of the muzzle.

Four species of *Stephanofilaria*, *S. assamensis*, *S. dedoesi*, *S. kaeli*, and *S. okinawaensis*, are distributed in Southeast Asia, India and Pakistan. There were outstanding differences in the site of appearance of main clinico-pathological changes among these species. Moreover, there was a conspicuous morphological difference between *S. kaeli* and any other species. There were little differences in morphology among the other three species.

S. zaherri, a species found in India by Singh (1958), was regarded as a synonym in the review written by Patnaik et al. (1968). It is problematic to establish an independent species for organisms which differ simply in the site of parasitism and which differ a little in the size of the worm body and in values measured from those of any known species.

From this point of view, it is necessary to study the surface structure of the parasites comparatively by scanning electron microscopy in order to clarify the morphological characteristics of various species of *Stephanofilaria* distributed in Southeast Asia, India, and Pakistan.

Distribution of *S. okinawaensis* and clinical signs of stephanofilariasis of cattle

Bovine stephanofilariasis caused by infection with *S. okinawaensis* was prevalent among cattle, almost all of which were of the indigenous Japanese Black breed, raised in islets of the Southwestern Islands, including the



Plate 3. Changes of the teat of a Holstein cow induced by infection with *Stephanofilaria okinawaensis*. The teat was swollen and affected with ulcerative changes.

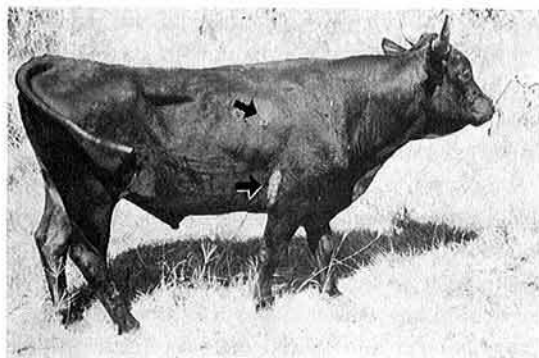


Plate 4. Changes of dermatitis in a Japanese Black bull induced by infection with *Stephanofilaria okinawaensis*. Arrow indicates a site showing changes. These changes appeared at almost the same site on the opposite side.

Yaeyama Islands and scattered from the southern end of Kyushu to that of Okinawa Prefecture. In these islets, almost all the cattle are pastured on the full or part-time basis. Only a few cattle are held in the barn. Stephanofilariasis has broken out exclusively among full and part-time pastured cattle. Barn-held cattle have been free from it.

In addition to cattle, small numbers of goats, horses, swine and water buffaloes are reared in those islets. None of them, however, have ever manifested any symptom of stephanofilariasis.

Most characteristic changes of cattle in-

fectured with *Stephanofilaria* were chronic inflammatory alterations of the muzzle, including swelling of the muzzle and erosion, necrosis, hemorrhage, and defect of the mucous membrane of the muzzle. As almost all the melanophores were destroyed in the papillary layer beneath the mucosa of the muzzle, this mucosa, which was black in a normal state, turned to be white. Pruritis was intense. Hemorrhage occurred readily at the affected site by rubbing against an article.

These changes in the muzzle were observed in calves more than 4 months of age, as well as in adult cattle. The older the animals of a herd, the higher the rate of infection in this herd. In the Yaeyama Islands where about 20,000 cattle have been raised annually, this rate was 66% in about 1,800 full-time pastured animals and 26% in about 1,700 part-time pastured animals surveyed. Characteristics of clinical changes of teats infected with the *Stephanofilaria* varied a little with the lapse of time after the clinical onset of disease, parity, and the presence or absence of an accompanying suckling calf.

The principal changes of the affected teat were local or universal inflammatory swelling, necrosis, erosion, hemorrhage, incrustation, ring-like splitting, and disappearance of melanin. When incrustation and decrustation were repeated, the teat was indurated and atrophic to obstruct lactiferous canalicules. It was not rare for some cows to show acanthosis. In cows accompanying suckling calves, the teat was ready to split and the distal half of it sometimes fell off.

These changes of the teat were rarely observed in heifers. As is the case with the changes of the muzzle, they became more and more serious with the advance in age, particularly in parity. Simultaneously, there was an increase in the number of teats affected. In the Yaeyama Islands changes of the teat were found in multiparous cows more than 16 months of age; that is, in 25% of about 1,700 full-time pastured animals and 23% of about 1,400 part-time pastured ones surveyed.

In districts where stephanofilariasis was

prevalent, intractable chronic dermatitis of varying extension was noticed rather frequently in the hairy part of the body surface, in addition to the above-mentioned changes in such hairless areas as muzzle and teat. The cutaneous changes were caused on the lateral side of the breast and in the costal and knee regions. In many animals they appeared symmetrically on both sides of the body. Very rarely, dermatitis with similar symptoms was observed also in the lower parts of the four limbs. Recently, *Stephanofilaria* worms were detected from such skin lesions as mentioned above. Therefore, it was concluded that infection with *S. okinawaensis* produced pathological changes in the hairy part of the body surface in addition to the muzzle and teat. *Stephanofilaria* infection may be induced by a mechanical injury (trauma) on the body surface of cattle.

The above-mentioned changes caused by *Stephanofilaria* infection are alleviated a little when a cool season sets in, but exacerbated when a hot season comes. Accordingly, infected cattle can hardly be cured, so long as they are reared in a contaminated district.

Intermediate host of *S. okinawaensis*

Srivastava et al. (1963) reported that the fly, *Musca conducens*, was an intermediate host of *S. assamensis*. After that, this fly was also found to be an intermediate host of *Stephanofilaria* sp. and *S. kaeli* by Kono and Fukuyoshi (1967) and Fadzil (1973), respectively.

In the summer of 1977, the authors collected flies swarming over lesions of the muzzle, teat, and other parts of the skin in cattle reared on five pastures in the Ishigaki and adjacent islands where stephanofilariasis was highly prevalent. These flies were classified in the following manner.

The flies collected were divided into two genera, *Musca* and *Morellia*, and seven species, which consisted of *Musca conducens*, *M. convexifrons*, *M. fasciata*, *M. sorbens*, *M. ventrosa*,

an unidentified species of *Musca*, and *Morellia hortensia*. Two species, *M. conducens* and *M. fasciata*, were so predominant that they occupied more than 80% of all the flies collected. The remaining five species were all minor ones.

The flies of each species were divided into sexes and examined for the rate of harboring of developmental stages of *Stephanofilaria* in the flies collected. They were small hematophagous flies. Pre or infective stage of *Stephanofilaria* were detected exclusively from the head with the proboscis of *M. conducens* immersed in physiological saline. The rate of detection of them was a little more than 5%.

Chemotherapy of stephanofilarial sore

In Southeast Asia and India, stephanofilarial sore is treated with such ointments as negvon and azuntol, which were prepared by mixing organic phosphorus compounds with vaselin and linseed oil. Not a few papers have been published to report that these drugs are effective to some extent for this disease.

The authors prepared tentatively ointments containing these organic phosphorus compounds in various proportions. These ointments were applied to lesions of the muzzle, teat, and other parts of the skin.

The affected teats of cows which were not nursing a calf and lesions of the hairy part of the skin were cured to some extent by treatment with these ointments, but were not cured perfectly. When an ointment was applied to the muzzle, it was licked by the cow and failed to display any effect. When it was applied to the teat of a cow nursing a calf, it was licked by the calf before it revealed its effects.

Anyway, it is difficult to apply such ointment to the muzzle which is readily affected with the parasite. Besides, it is necessary to apply the ointment quite frequently even to lesions induced in any region other than the muzzle. Accordingly, the application of an

ointment is too troublesome a method of treatment to be used generally in the field, even if it is efficacious.

Instead of the ointments, such drugs as levamisole and parbendazole which show anthelmintic effect of wide spectrum on parasitic nematodes have been used in a basic experiment on treatment by the oral or parenteral route. As a result, it has been demonstrated that the two drugs, when administered singly at a given appropriate dose, present an excellent therapeutic effect on lesions of the muzzle, teat, and other parts of the skin.

In near future, an experiment will be carried out to compare the anthelmintic effect on *Stephanofilaria* between the two drugs. It will be determined from such experiment that at what intervals each drug should be administered to cattle to prevent lesions of *Stephanofilaria* infection from appearing.

References

- 1) Fadzil, M.: *Musca conducens* Walker, 1859-its prevalence and potential as a vector of *Stephanofilaria kaeli* in Peninsular Malaysia. *Kajian Vet.*, 5(2), 27-37 (1963).
- 2) Kono, I.: Leucoderma of the muzzle of cattle induced by a new species of *Stephanofilaria*. I. *Jap. J. Vet. Sci.*, 27, 33-39 (1965) [In Japanese with English summary].
- 3) Kono, I. & Fukuyoshi, S.: Leucoderma of the muzzle of cattle induced by a new species of *Stephanofilaria*. II. *Jap. J. Vet. Sci.*, 29, 301-313 (1967) [In Japanese with English summary].
- 4) Patnaik, B. & Roy, S. P.: Studies on stephanofilariasis in Orissa. II. Dermatitis due to *Stephanofilaria assamensis* Pande, 1936, in the murrh buffalo (*Bos bubalis*) and the beetle buck (*Capra hircus*) with remarks on the morphology of the parasite. *Indian J. Vet. Sci.* 38, 455-462 (1968).
- 5) Singh, S. N.: On a new species of *Stephanofilaria* causing dermatitis of buffalo's ears in Hyderabad (Andhra Pradesh), India. *J. Helminthol.* 32, 239-250 (1958).
- 6) Srivastava, H. D. & Dutt, S. C.: Studies on the life-history of *Stephanofilaria assamensis*, the causative parasite of humpsore of Indian cattle. *Indian J. Vet. Sci.* 33, 173-177 (1963).
- 7) Ueno, H. & Chibana, T.: *Stephanofilaria okinawaensis* n. sp. from cutaneous lesions on the teats of cows in Japan. *Nat. Inst. Anim. Hlth. Quart.*, 17, 16-26 (1977).
- 8) Ueno, H., Chibana, T. & Yamashiro, E.: Occurrence of chronic dermatitis caused by *Stephanofilaria okinawaensis* on the teats of cows in Japan. *Vet. Parasitol.*, 3, 41-48 (1977).